

Applicant(s): Brian A. Vaartstra

Serial No. Unknown (Parent Serial No. 10/032,049)

Filed: Herewith (Parent: December 21, 2001)

For: METHODS FOR PLANARIZATION OF METAL-CONTAINING SURFACES USING HALOGENS AND HALIDE SALTS

Amendments to the Claims

This listing of claims replaces all prior versions, and listings, of claims in the above-identified application:

Listing of Claims

1-50. Cancelled

51. (Original) A planarization method comprising:

positioning a metal-containing surface of a substrate to interface with a polishing surface; wherein the metal-containing surface comprises a metal selected from the group consisting of a Group VIII^B metal, a Group IB metal, and a combination thereof;

supplying a planarization composition in proximity to the interface; and

planarizing the substrate surface;

wherein the planarization composition comprises a halogen-containing compound and a halide salt, with the proviso that the planarization composition does not include abrasive particles.

52. (Original) The method of claim 51 wherein the metal-containing surface of the substrate comprises a metal selected from the group consisting of a Group VIII^B metal, a Group IB metal, and a combination thereof, which is in elemental form or an alloy thereof.

53. (Original) The method of claim 51 wherein the metal-containing surface of the substrate comprises a metal selected from the group consisting of a Group VIII^B second row metal, a Group VIII^B third row metal, a Group IB second row metal, a Group IB third row metal, and a combination thereof.

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54. **(Original)** The method of claim 53 wherein the metal-containing surface of the substrate comprises a metal selected from the group consisting of Rh, Pd, Pt, Ir, and Ru.

55. **(Original)** The method of claim 54 wherein the metal-containing surface comprises elemental platinum.

56. **(Original)** The method of claim 51 wherein the metal is present in an amount of about 50 atomic percent or more.

57. **(Original)** The method of claim 51 wherein the substrate is a semiconductor substrate or substrate assembly.

58. **(Original)** The method of claim 51 which is carried out in one step.

59. **(Original)** The method of claim 51 wherein the halogen-containing compound is selected from the group consisting of a halogen, an interhalogen, a halogen-generating compound, and combinations thereof.

60. **(Original)** The method of claim 51 wherein the halogen-containing compound is selected from the group consisting of a halogen; an interhalogen; a halogen-generating compound selected from the group consisting of XeF₂, HgF₂, SF₄, alkyl halides, and complexes of halogen with organic bases; and combinations thereof.

61. **(Original)** The method of claim 51 wherein the halogen-containing compound is selected from the group consisting of F₂, Cl₂, Br₂, I₂, ClBr, IBr, ICl, BrF, ClF, ClF₃, BrF₃, ClF₅, IF₅, IF₇, XeF₂, HgF₂, SF₄, alkyl halides, and complexes of halogen with organic bases, and combinations thereof.

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62. **(Original)** The method of claim 51 wherein the halogen-containing compound is selected from the group consisting of ClBr, IBr, ICl, BrF, ClF, ClF₃, BrF₃, ClF₅, IF₅, IF₇, XeF₂, HgF₂, SF₄, alkyl halides, and complexes of halogen with organic bases, and combinations thereof.
63. **(Original)** The method of claim 51 wherein the halide salt is an inorganic salt.
64. **(Original)** The method of claim 63 wherein the inorganic halide salt is selected from the group consisting of NaI, KCl, KBr, NH₄F, and combinations thereof.
65. **(Original)** The method of claim 51 wherein the halide salt is an organic salt.
66. **(Original)** The method of claim 65 wherein the organic salt is selected from the group consisting of Et₄NBr, Me₃NHCl, Me₄NF, and combinations thereof.
67. **(Original)** The method of claim 51 wherein the halogen-containing compound is present in the planarization composition in an amount of at least about 0.1% by weight and the halide salt is present in the planarization composition in an amount of at least about 0.1% by weight.
68. **(Original)** The method of claim 51 wherein the halogen-containing compound is present in the planarization composition in an amount of about 1% to about 10% by weight.
69. **(Original)** The method of claim 51 wherein the halide salt is present in the planarization composition in an amount of about 1% to about 10% by weight.
70. **(Original)** The method of claim 51 wherein the halogen of the halogen-containing compound is different than the halogen of the halide salt.

Preliminary Amendment

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71. **(Original)** The method of claim 51 wherein the planarization composition is not basic.

72. **(Original)** The method of claim 51 wherein the polishing surface comprises a fixed abrasive article.

73. **(Original)** A planarization method comprising:

- providing a semiconductor substrate or substrate assembly including at least one region of a platinum-containing surface;
- providing a polishing surface;
- providing a planarization composition at an interface between the at least one region of platinum-containing surface and the polishing surface; and
- planarizing the at least one region of platinum-containing surface;

wherein the planarization composition comprises a halogen-containing compound and a halide salt, with the proviso that the planarization composition does not include abrasive particles.

74. **(Original)** The method of claim 73 wherein the platinum-containing surface of the substrate comprises platinum in elemental form.

75. **(Original)** The method of claim 73 wherein the platinum is present in an amount of about 50 atomic percent or more.

76. **(Original)** The method of claim 73 wherein the semiconductor substrate or substrate assembly is a silicon wafer.

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77. **(Original)** The method of claim 73 wherein the halogen-containing compound is selected from the group consisting of a halogen, an interhalogen, a halogen-generating compound, and combinations thereof.

78. **(Original)** The method of claim 73 wherein the halogen-containing compound is selected from the group consisting of a halogen; an interhalogen; a halogen-generating compound selected from the group consisting of XeF_2 , HgF_2 , SF_4 , alkyl halides, and complexes of halogen with organic bases; and combinations thereof.

79. **(Original)** The method of claim 73 wherein the halogen-containing compound is selected from the group consisting of F_2 , Cl_2 , Br_2 , I_2 , ClBr , IBr , ICl , BrF , ClF , ClF_3 , BrF_3 , ClF_5 , IF_5 , IF_7 , XeF_2 , HgF_2 , SF_4 , alkyl halides, and complexes of halogen with organic bases, and combinations thereof.

80. **(Original)** The method of claim 73 wherein the halide salt is an inorganic salt.

81. **(Original)** The method of claim 80 wherein the inorganic halide salt is selected from the group consisting of NaI , KCl , KBr , NH_4F and combinations thereof.

82. **(Original)** The method of claim 73 wherein the halide salt is an organic salt.

83. **(Original)** The method of claim 82 wherein the organic salt is selected from the group consisting of Et_4NBr , Me_3NHCl , Me_4NF , and combinations thereof.

84. **(Original)** The method of claim 73 wherein the halogen-containing compound is present in the planarization composition in an amount of at least about 0.1% by weight and the halide salt is present in the planarization composition in an amount of at least about 0.1% by weight.

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85. **(Original)** The method of claim 73 wherein the halogen-containing compound is present in the planarization composition in an amount of about 1% to about 10% by weight.

86. **(Original)** The method of claim 73 wherein the halide salt is present in the planarization composition in an amount of about 1% to about 10% by weight.

87. **(Original)** The method of claim 73 wherein the polishing surface comprises a fixed abrasive article.

88. **(Original)** A planarization method for use in forming an interconnect, the method comprising:

providing a semiconductor substrate or substrate assembly having a patterned dielectric layer formed thereon and a metal-containing layer formed over the patterned dielectric layer, wherein the metal-containing layer comprises a metal selected from the group consisting of a Group VIIIB metal, a Group IB metal, and a combination thereof;

positioning a first portion of a polishing surface for contact with the metal-containing layer;

providing a planarization composition in proximity to the contact between the polishing surface and the metal-containing layer; and

planarizing the metal-containing layer;

wherein the planarization composition comprises a halogen-containing compound and a halide salt, with the proviso that the planarization composition does not include abrasive particles.

89. **(Original)** The method of claim 88 wherein the halogen-containing compound is selected from the group consisting of a halogen, an interhalogen, a halogen-generating compound, and combinations thereof.

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90. **(Original)** The method of claim 88 wherein the halogen-containing compound is selected from the group consisting of a halogen; an interhalogen; a halogen-generating compound selected from the group consisting of XeF_2 , HgF_2 , SF_4 , alkyl halides, and complexes of halogen with organic bases; and combinations thereof.
91. **(Original)** The method of claim 88 wherein the halogen-containing compound is selected from the group consisting of F_2 , Cl_2 , Br_2 , I_2 , ClBr , IBr , ICl , BrF , ClF , ClF_3 , BrF_3 , ClF_5 , IF_5 , IF_7 , XeF_2 , HgF_2 , SF_4 , alkyl halides, and complexes of halogen with organic bases, and combinations thereof.
92. **(Original)** The method of claim 88 wherein the halide salt is an inorganic salt.
93. **(Original)** The method of claim 92 wherein the inorganic halide salt is selected from the group consisting of NaI , KCl , KBr , NH_4F and combinations thereof.
94. **(Original)** The method of claim 88 wherein the halide salt is an organic salt.
95. **(Original)** The method of claim 94 wherein the organic salt is selected from the group consisting of Et_4NBr , Me_3NHCl , Me_4NF , and combinations thereof.
96. **(Original)** The method of claim 88 wherein the halogen-containing compound is present in the planarization composition in an amount of at least about 0.1% by weight.
97. **(Original)** The method of claim 96 wherein the halogen-containing compound is present in the planarization composition in an amount of about 1% to about 10% by weight.

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98. **(Original)** The method of claim 88 wherein the halide salt is present in the planarization composition in an amount of at least about 0.1% by weight.

99. **(Original)** The method of claim 98 wherein the halide salt is present in the planarization composition in an amount of about 1% to about 10% by weight.

100. **(Original)** The method of claim 88 wherein the polishing surface comprises a fixed abrasive article.

101. **(Original)** A planarization method comprising:

- positioning a metal-containing surface of a substrate to interface with a polishing surface comprising a fixed abrasive article, wherein the metal-containing surface comprises a metal selected from the group consisting of a Group VIIIB metal, a Group IB metal, and a combination thereof;

- supplying a planarization composition in proximity to the interface; and

- planarizing the substrate surface;

wherein the planarization composition comprises a halogen-containing compound and a halide salt.

102. **(Original)** A planarization method comprising:

- providing a semiconductor substrate or substrate assembly including at least one region of a platinum-containing surface;

- providing a polishing surface comprising a fixed abrasive article;

- providing a planarization composition at an interface between the at least one region of platinum-containing surface and the polishing surface; and

- planarizing the at least one region of platinum-containing surface;

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wherein the planarization composition comprises a halogen-containing compound and a halide salt.

103. **(Original)** A planarization method for use in forming an interconnect, the method comprising:

providing a semiconductor substrate or substrate assembly having a patterned dielectric layer formed thereon and a metal-containing layer formed over the patterned dielectric layer, wherein the metal-containing layer comprises a metal selected from the group consisting of a Group VIIIB metal, a Group IB metal, and a combination thereof;

positioning a first portion of a polishing surface comprising a fixed abrasive article for contact with the metal-containing layer;

providing a planarization composition in proximity to the contact between the polishing surface and the metal-containing layer; and

planarizing the metal-containing layer;

wherein the planarization composition comprises a halogen-containing compound and a halide salt.